

# Czech position to the new version of EN50160 standard

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**Abstract:** The paper presents general results of a three-year measurement of voltage quality (VQ) carried out at a selected sample of 80 LV distribution networks in all regions of the Czech Republic, both from the point of view of the standard EN 50160:2007 [1] and with regard to its proposed changes [2] elaborated based on the requirements of ERGEG [3]. The paper also deals with possible consequences for DNOs relating to compensations to customers for VQ acc. to ERO Decree [4] and, with the costs for reconstruction of all LV networks, in which some parts do not fulfil the valid EN 50160 and its proposed changes.

## 1. INTRODUCTION

The LV distribution system of the Czech Republic represents 140 thousands km of LV lines (47% of cables), 88 thousands distribution transformer stations (DTS) and nearly 6 millions of supply points. The technical lifetime of this equipment is considered to be 35 – 45 years. More strict requirements on the parameters of supplied electricity may involve the necessity to reconstruct power networks which were designed complying with criteria and standards valid at the time of their construction, prior to the end of their life-time.

The demand to increase the VQ in the whole LV distribution network should respect the present state of networks and the real needs of supplied customers. The responsibility for the VQ should be divided between customers with disturbing appliances and the DNO. The general increasing the quality even in old networks would lead to increasing the costs of distribution, which brings no benefit to most of customers, but they would be forced to pay it. The DNO forced to invest into modernizing networks under the threat of sanctions for not meeting the standards according to [4], would be therefore criticized for high distribution costs.

## 2. EXPLORATION OF ACTUAL LV NETWORKS VOLTAGE QUALITY

For evaluating of the possible impacts of prepared changes in standard [4], all major DNOs in the Czech Republic organized a measuring campaign in 80 LV networks in the year 2006. All collected data were evaluated in unified way by independent company EGC-CR. After data analysis it was decided to continue the campaign in the following years with two stages of measurement in each year (summer and winter period). The same agglomerations for measuring campaign were selected in 2006, 2007 and 2008. This make possible to evaluate the development of the level of characteristic voltage quantities during the periods of measurement. Different agglomerations for measuring campaigns in 2008 were chosen only in those cases when the networks of the

respective agglomerations were reconstructed in the year 2006 or 2007.

The voltage quality measurement in LV networks of the Czech Republic, carried out on a sample of 80 networks, revealed that about 10% of networks monitored do not satisfy the present limits for voltage level according to [2] and the acceptance of proposals according to [3] would result in increasing their number by up to 5% approximately. A much higher number of networks do not satisfy from the flicker point of view. The matter concerns up to 50% of customers at the end of measured feeders. The limits for harmonics and for voltage unbalance are not exceeded. There is a wide dispersion of VQ parameters, above all in flicker comparing the four realized measurements stages. The exceeding of the permitted limits was also stated at 15 to 23% of points where the internal impedance of the network was less than its reference value according to [6].

The importance of realized measurements increased also in connection with the considered increasing the number of percentiles of 10 minute measuring intervals from 95% to 99%, in which the voltage must be within the given limits. Acquired data enable to assess the impact of this percentile change.

## 3. IMPACT OF ACHIEVING COMPLIANCE WITH NEW VERSION OF EN50160

The requirement for a rapid achieving of the compliance of LV networks with [1] and/or [2] is not realistic. Among other problems it would lead to stopping investments for reconstructions of HV and MV distribution networks for several years. Also it would lead to capacity problems both on the side of the energy sector itself and on the side of external suppliers of projection and building services.

Especially with regard to a changing structure of appliances sensitive to flicker together with small number of claims and to high costs of reconstructions we do not consider to accelerate total-wide reconstructions of the networks without evaluating the appropriateness and justification of present limits for Pst and Plt.

In the last year was the poor VQ rightfully claimed by less than 0,1 % of customers (related to their total number).

#### 4. COSTS OF IMPROVING THE VOLTAGE QUALITY

Better voltage quality in the distribution system can be practically achieved by two ways:

- using of appliances with lower disturbing emissions
- increasing the short-circuit power in the distribution network

Due to a high number of LV networks which do not fulfill the requirements on electricity quality according to [1] and with regard to the structure of consumption it is not realistic to evaluate the measure in which the poor quality of electricity is responsibility of some customer and the extent in which it is caused by a high impedance of the network. With respect to high number of customers, a realistic way may be mostly decreasing the internal impedance of the network (increasing the short-circuit power).

The increasing of the short-circuit power in the distribution network means the refurbishment of some of its elements before the end of their lifetime and a considerable over-dimensioning of new elements with regard to power being transmitted. The over-dimensioning is considered only for achieving low internal impedance at the point of delivery between DNO and the customer.

Direct investment costs for achieving the already valid tolerances for the voltage in the Czech LV networks are estimated approximately to 400 millions €. In the case of accepting more stringent limits  $230\text{ V} \pm 10\%$  in percentile 99% these direct investment costs would be increased up to approximately 413 millions €. For a full compliance with the EN 50160 standard, i. e. including the flicker, direct investment costs could be estimated in the amount of 800 millions €.

#### CONCLUSION

Most of today operated networks could not be and were not designed in accordance with the present requirements on quality of electricity, with which the connected loads are not in accordance, too. New limits bring increasing number of networks with voltage deviation out of limit and the customers would be entitled to get compensation or lower price of electricity. The new upper limit of 115%  $U_n$  for the 10 min mean RMS values is difficult to be used in most networks. On the basis of measurements, taken on approx. 80% networks since 2006, 40 to 50% of networks do not confirm the new parameters. Considering the quantity of networks not satisfying the new limits, the period of 15 years should be supposed until the conformity is reached.

Tighten VQ limits are acceptable only in the case of new networks and the networks under reconstruction in which the loads and their disturbing emission are in accordance with valid standards and are designed to meet their demands.

Special surveys concerning the satisfaction of customers with the quality of supplied electricity and their willingness

to pay a higher price for better quality have not yet been organized in Czech Republic. Undoubtedly a criterion of the need for improving the electricity quality parameters can be identified from the number of claims concerning the quality and their justification. In the case of two major Czech DNOs the claims concerning the quality make not more than 3% of the whole number of claims. Related to the number of customers it is less than 0.1%.

#### REFERENCES

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